Digitization and the welfare effects of motion picture trade

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Digitization and the Welfare Effects of Motion Picture Trade*

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Extended Abstract

Digitization has importantly affected the motion picture industry, decreasing the costs of producing and distributing films, and making them increasingly available to consumers via digital distribution, both across and within countries. Despite these changes, certain characteristics of the European film market are still standing in the way of a full convergence of choice sets across countries. In particular, territorial licensing and geo-blocking within the European Union prevent consumers from certain EU countries to access films available in others, acting as trade barriers across EU Member States. European policymakers are currently considering the creation of a European digital single market (DSM). Under such policy, a digital product available in one Member State would automatically be available in all States. The goal of this paper is to evaluate the economic benefits created by a European DSM for consumers and producers, in Europe and around the world. Our analysis relies on box-office revenue data for a list of over 21,000 distinct films released in theaters in 52 countries during the years 2002-2014. We develop a structural model of demand for films which allows us to obtain the economic surplus for consumers in each destination country as well as the revenue collected for producers in each origin country. Our model allows us to simulate a European DSM by comparing the current status quo with a fully open European market (the EU DSM) in which every film available somewhere in the EU is made available everywhere in the EU.

We highlight the important distinctions between our counterfactual simulations - which involve theatrical distribution - and the ideal counterfactual scenario we would like to simulate - a DSM in a context with digital distribution. First, our simulation should be interpreted as the elimination of any barriers to trade within the EU for theatrically released films only. This means that we are not able to directly estimate the effects of a EU DSM in an environment that includes the long tail of films (i.e. films that would not be released in theaters but that would be available in digital format). Second, while the set of films that become available under our simulation of a DSM is limited by our theatrical data, we implicitly assume that theatrical capacity constraints are not binding. In other words, we

assume that theaters in every country are able to sustain the greater number of films that a EU DSM would deliver. Finally, our simulations only allow us to estimate the effect of making current films available everywhere in the EU. This is because the theatrical data only allow us to estimate the current appeal of films (i.e. in the year that they are released) for a given calendar year, and not the appeal of older films. This is in contrast with a EU DSM under digital distribution, which would permit access not only to currently available films in digital format, but also to older films.

In sum, our counterfactuals do not allow us to make a direct estimation of the magnitude of the effect of a EU DSM with digital distribution. They do, however, allow us to understand how film producers from different countries would be affected by a policy resembling a DSM in the sense of broadly similar changes in repertoire availability. In particular, they allow us to understand whether - for each origin country of production - the gains from reaching a larger set of foreign consumers offset the negative effect of facing more competition in their home market.

Our results show that increasing availability of films across Europe via a DSM would mostly benefit European film producers at the expense of US film producers. In particular, our results show that a European Digital Single Market would increase revenues to European producers by an average of 0.46 euro per capita (an 11% increase in revenue compared to the status quo). US producers, on the other hand, would lose about 0.78 euro per capita (a 1.8% decrease in revenue compared to the status quo). We explain this result by the fact that most US films are already available in most EU countries under the status quo, while European films are much less available prior to a DSM. In our simulations, the main effect of a DSM is therefore to increase competition faced by US producers of ubiquitously available films. By construction, greater availability of films across the EU leads to gains for consumers in each Member State since our simulation of a DSM increases the choice set of every EU country. We conclude with a list of tasks that remain to be performed to conclude this still preliminary analysis of the economic effects of a European DSM.

1 Introduction

International film distribution has traditionally been expensive, requiring physical trade in film reels, as well as access to scarce film theaters in destination countries. In large European countries, the number of films exhibited in theaters each year falls short of domestic film production and, of course, far short of international production. As a result, consumers have not traditionally had unfettered access to films, and producers have been inhibited in their attempts to find consumers.

Digitization has changed the film market in a variety of ways. First, digitization has reduced the costs of producing films.[1] Second, digitization has reduced producers' costs of distribution as well as consumers' costs of getting access to films, both within and across countries. Now, and increasingly, films are available to consumers via direct digital distribution. While consumers faced a limited choice set in theaters, digitization has given them access to wider arrays of choices. In the US in 2012, for example, consumers had access to over 1,000 different titles originally released in 2010 which had not been exhibited in theaters.

Consumers in different EU member states have access to different sets of films, for a variety of reasons. First, preferences differ, so not all films marketable in one state are broadly appealing in another. Second, territorial licensing and geo-blocking lead to a fragmentation of the EU market, by preventing consumers located in a given EU Member State from accessing content available in other Member States.[2] Additionally, even if a similar service is provided in several EU Member States, consumers typically only have access to the catalogue offered in their own country of residence. While Netflix may be available in both France and Germany, consumers in France may therefore not have the possibility to stream films from the German Netflix catalogue. These measures naturally

[1] Waldfogel (2016) documents substantial growth in the number of films produced annually since the development of inexpensive digital cameras in 2005.

[2] Geo-blocking is a commercial practice that prevents online consumers from accessing a website or purchasing content based on location. See, for instance, https://epthinktank.eu/2015/05/13/digital-single-market-and-geo-blocking/. These commercial strategies are based on the principle of copyright territoriality. See Renda et al. (2015) for a more detailed description the relationship between territorial licensing and EU copyright law in the audio-visual sector.

inhibit free trade across European borders, so European consumers have fewer options (Gomez and Martens, 2015). European policy makers are currently pursuing the creation of a digital single market (DSM) in Europe (European Commission, 2015). Under the proposed policy, territorial restriction for digital films would be eliminated. As a result, a digital product available in one Member State would be available in all States.

These possibilities raise a series of questions. First, how has the number of films produced evolved over time? Second, how many films are available annually in each country via theatrical distribution, as opposed to the number of films produced? Third, how does the prospect of a digital single market affect the consumers and producers around Europe? Making films available in more destinations should increase the options available to consumers. Greater availability of foreign films should therefore benefit consumers around the world. Effects on producers are less clear a priori. On the one hand, the existing fragmented system acts as de facto protectionism, reducing the amount of competition faced by domestic products. On the other hand, the effective trade barriers make it more difficult for producers to derive foreign revenue from their products. Hence, a DSM could either raise or lower the revenue earned by particular country repertoires. Producing countries whose revenues rose would presumably expand their film investment, while investment would contract in countries losing revenue in the face of greater competition.

Moreover, it is not clear a priori how the establishment of a digital single market would affect European, as opposed to US, producers. Under a DSM, products available in any European country would be available in all others, regardless of where the products are originally. Hence, a DSM regime could make the films from the US more ubiquitously available throughout Europe, strengthening the competition that European producers face from the US.[3] Some industry practitioners anticipate this impact of a DSM.[4]

[3]Digital distribution would give consumers access not only to additional contemporary products but also to films produced in prior years. It would be of interest to understand how the presence of many older films in the choice sets would affect demand for new films by origin country. Because we rely on theatrical box office data, we lack consumption data from contexts in which older films are in the choice sets of consumers and hence cannot make this part of our analysis.

[4]According to a French cinema operator, a DSM would enhance the position of US products in the European market. "If the European Commission goes this way, they are really preparing their own market for the invasion of American product," he says. "If we want to kill European audiovisual culture and diversity, then the European Commission is on the right path." Theatrical exhibitor Nico Simon, quoted in the Hollywood Reporter (http://www.hollywoodreporter.com/news/europe-digital-sin

Yet, if European films are not ubiquitously available around the EU without a DSM while US films already are, then a DSM will raise European availability relative to US, which would promote European cinema relative to the US. Whether a DSM strengthens the competition provided by European vs US repertoires is an empirical question that depends on the respective repertoires' status quo availability, as well as the appeal of products that a DSM would make available.

The goal of this paper is to provide background data, along with an explicit demand model, allowing us to characterize the impact of a DSM reform. We would like to know the pattern of film consumption that EU consumers would choose if they faced a DSM. To analyze this, we would ideally like to observe choices consumers would make when facing broad options like those in a digital - rather than a theatrical - environment. Because this regime has not existed, we cannot observe the appeal of all films in all destinations. We can, however, observe choice among the options available in theaters. All films appear in at least one location, and many appear in multiple destinations. If the appeal of films is correlated across countries - and we will show that it is - then we can use the theatrical consumption data to develop estimates of the appeal of films in destinations where they were not exhibited. In particular, we can plausibly simulate consumption choices in the face of the broad options consumers would face with digital distribution. We note the important distinctions between our counterfactual simulations - which involve theatrical distribution - and the ideal counterfactual scenario we would like to simulate - a DSM in a context with digital distribution. First, our simulation should be interpreted as the elimination of any barriers to trade within the EU for theatrically released films only. This means that we are not able to directly estimate the effects of a EU DSM in an environment that includes the long tail of films (i.e. films that would not be released in theaters but that would be available in digital format). Second, while the set of films that become available under our simulation of a DSM is limited by our theatrical data, we implicitly assume that theatrical capacity constraints are not binding. In other words, we assume that theaters in every country are able to sustain the greater number of films that a EU DSM would deliver. In sum, our counterfactuals do not allow us to make a

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direct estimation of the magnitude of the effect of a EU DSM with digital distribution. They do, however, allow us to understand how film producers from different countries would be affected by a policy resembling a DSM in the sense of broadly similar changes in repertoire availability. In particular, they allow us to understand whether - for each origin country of production - the gains from reaching a larger set of foreign consumers offset the negative effect of facing more competition in their home market.

We find, perhaps surprisingly, that increasing availability of films across Europe via a DSM would mostly benefit European film producers at the expense of US film producers. In particular, our results show that a European Digital Single Market would increase revenues to European producers by an average of 0.46 euro per capita (an 11% increase in revenue compared to the status quo). US producers, on the other hand, would lose about 0.78 euro per capita (a 1.8% decrease in revenue compared to the status quo). We explain this result by the fact that most US films are already available in most EU countries under the status quo, while European films are much less available prior to a DSM. In our simulations, the main effect of a DSM is therefore to increase competition faced by US producers of ubiquitously available films. By construction, greater availability of films across the EU leads to gains for consumers in each Member State since our simulation of a DSM increases the choice set of every EU country. We find that European consumers would gain an average of 0.23 euro per capita (an increase of 1.8% compared to the status quo).

The paper proceeds in 6 steps after the introduction. Section 2 describes the data. Section 3 presents descriptive results on the number of films exhibited by country and year, production by country and year, as well as which countries trade with each other. Section 4 presents our explicit discrete choice nested logit demand model as well as estimation results. Section 5 presents evidence about the correlation of film preferences across country and uses these relationships to make predictions of the appeal of films in destinations where they we not exhibited. These are in turn used to make counterfactual simulations. Section 5.2 presents our estimates of the impact of the DSM on producers and consumers in Europe and the US. We also present results of counterfactual simulations

of autarky as well as worldwide frictionless trade (as in Aguiar and Waldfogel, 2014). Section 6 concludes and discusses a list of tasks that remain to be performed in order to complete our analysis.

2 Data

The first major data set for this paper comes from Box Office Mojo and provides us with a list of 25,044 distinct films released in theaters in 59 countries during the years 2002-2014, along with their box office revenue by destination country. Not all countries are available in all years, but the data contain at least 50 countries for each year since 2008. Overall, we have 109,820 film country year observations (note that films are included in their release year).

In value terms, the box office revenue in these data account for over 80 percent of world film revenue. The MPAA reports that worldwide theatrical box office revenue rose from $31.6 billion to $36.4 billion between 2010 and 2014.[5] Our revenue account for 26.2 billion in 2010 and $30.6 billion in 2014, or about 84 percent of world box office revenue.

For most films – and for essentially all of the films in the data for 2013 – we also have data on the films' country of origin. We obtained these from IMDb, which lists each film's country, or countries, of origin. We focus on the first listed origin country in most of our analysis.

We supplement these film level data with country-year data on film ticket prices, population, and per-capita income. Ticket prices are derived from four distinct sources. First, ticket prices for 2002-2010 are obtained from Screen Digest. Second, we obtain ticket prices for 41 selected countries for 2011 from UNESCO. Third, we obtain data on ticket prices for the years 2012 and 2013 for 9 countries from the National Center of Cinematography and the moving image (CNC). Finally, we obtain data on ticket prices for 14 other countries for years 2012-2014 by combining the LUMIERE database on film admissions

[5] http://www.mpaa.org/wp-content/uploads/2015/03/MPAA-Theatrical-Market-Statistics-2014.pdf.

in Europe with our box-office revenue data.[6] For each country and each year, we compute the average ticket price by dividing the aggregated yearly box-office revenue by the number of overall yearly admissions in the country. Data on population and GDP per capita are obtained from the World Bank Open Data.[7]

We also have country-year level data on the number of films produced in each country (whether theatrically released or not). We obtained these from IMDb database. Note the distinction between films that have been produced – and are listed in the IMDb database – and films released in theaters, which are listed in the Box Office Mojo data. In particular, we have the full list of full-length features (not documentaries) that IMDb reports to have been produced between 2002 and 2012. These data include 46,772 distinct films from 139 first-listed origin countries.

Our final sample includes the set of movies that appear in the countries and years where we observe all of the necessary variables for our estimations. Because we do not observe ticket prices in every country and year, the dataset we use for our estimations comprises 21,452 distinct movies observed in 52 countries over the period 2002-2014.[8] While we will use all years of data in our estimations, our descriptive analysis and counterfactual exercises will be performed using the 2013 data only, a year in which our final dataset contains 50 destinations, 20 of which correspond to EU Member States. Out of these 20 EU countries, only 17 have have data available on ticket prices - necessary to construct our welfare measures. We will therefore be able to provide descriptive statistics (for which no price information is needed) on the 20 EU Member States, but our counterfactual calculations will however be limited to this subset of 17 EU Member States only.

[6]The LUMIERE database is a product of the European Audiovisual Observatory and provides a systematic compilation of available data on admissions of the films released in European cinemas since 1996.

[7]See http://data.worldbank.org/.

[8]The EU countries for which no price ticket data is available are Belgium, Croatia, and Greece.

3 Descriptive Analysis

This section provides descriptive evidence on exhibition capacity, recent trends in film production, the availability of different repertoires around the world, and the patterns of world trade in films (based on box office revenue). These descriptive results provide simple previews of what we explore more deeply in the structural estimates later.

3.1 Digitization and Production

The cost of producing films has fallen over the past decade. As Waldfogel (2016) argues, the number of films created – and which have pages at IMDb – has increased correspondingly. He shows that the number of films created has increased over time – for features and documentaries – in both the US and the rest of the world. Here we present additional information on particular European countries.

As Figure 1a shows, there have been large increases in the number of films produced in both the US and some large European countries. In France, feature production has grown from about below 200 per year in the early 2000s to about 260 in 2012. German production has increased from under 140 to over 200. Italian production has risen from about 120 to 200. The pattern for Spain is similar. The patterns for the US and the UK stand apart. Feature production has roughly tripled in both countries. Figure 1b shows the patterns for Japan, Mexico, and the BRIC countries. All exhibit increases in production.[9]

[9]We note that the figures for China and India appear low (compared with Screen Digest production figures.) We have two possible explanations. First, we designate films according to their first listed country of origin. Second, the IMDb database might be incomplete for these countries. Previous literature has already documented issues related to the measurement of film production through various data sources for these countries. See Telang and Waldfogel (2014) for the case of India.

3.2 Number of Products Available in Theaters in Each Country

We can infer the number of films available in theaters in each country from the number of film appearing in the Box Office Mojo dataset for each country and year. The second column of Table 1 shows the number of films available in 2013 for countries in our sample. The third column shows the share of available films that are local (i.e. produced in the same country), and the last column presents the share of total films shown in theaters in the EU20 that is available in each country. Theatrical distribution places limits on the number of products in the country choice sets, and countries differ both in the number and in the share of films distributed theatrically each year.

In 2013, 687 films were exhibited in US theaters. Other countries with large numbers of films available include the UK (440), Spain (402), Germany (335), France (314),Belgium (377), Austria (336), and Portugal (302). Far fewer films were exhibited in the smaller European countries: under 150 in countries as Denmark and Slovenia, and Slovakia , among others. Countries with large shares of local films include the US (66%), followed by France (33%), Spain (28%), and Germany (22%).

Two things are clear from the foregoing descriptive analysis. First, as Waldfogel (2016) argues, there has been substantial growth in the number of feature films produced around the world. Second, the number of films produced per year substantially exceeds the capacity for theatrical exhibition. To put this another way, non-theatrical avenues of distribution have the potential to be increasingly important for motion pictures.

3.3 Whose Films are Available?

In the current status quo, many films from each origin country are available in each destination. But given the limited exhibition capacity of theaters, not all films are available either at home or abroad. The proposed DSM will make digitally distributed films available anywhere in the EU available everywhere in the EU. To see which origins' films are likely to gain more availability from this policy we can ask the following. Of the films

currently available somewhere in the EU, in how many EU countries are they available? If some origin countries' films are available in a limited number of EU countries, then a DSM will substantially increase their films' EU reach. On the other hand, if a repertoire is already widely available in the EU, then a DSM can have only a smaller impact on the repertoire's reach. Our next descriptive exercise characterizes the theatrical availability of films from each origin country.

We take the films released into theaters in 2013, a year in which our full dataset contains 50 destinations. Our descriptive analysis will focus on the 20 EU countries available in 2013 and on the US. For each film we calculate two figures. First, we calculate the number of countries in which the film is shown in theaters. Figure 2 shows the average number of EU destinations where films are available, among those already available somewhere in the EU, by origin. US films in the EU are available in an average of 8 countries, far ahead of Denmark, the UK, and France, which are all available in around 3 countries. Other countries averages are close to unity, indicating that when their films are available in the EU they are mostly available in a single market. Figure 2 strongly suggests that DSM can have a smaller impact on the availability of US films, whereas it can have a more substantial impact on the availability of European films around the EU.

The descriptives in Figure 2 treat destinations the same regardless of size, so we also calculate the "reach" of the films: the share of all-destination GDP accounted for by films where the film is in theaters. Thus, for each film j we have a percentage of Europe (by GDP) where the film is available (r_j). We then calculate the average of this measure across films from each origin. In calculating this average we weight each film's r_j by the film's worldwide revenue. Figure 3 reports the weighted average reach by origin. Films from the US have widest reach, over 90 percent, followed by the UK (around 60 percent), Spain, France, Germany, and Denmark. Again, these figures suggest a relatively smaller impact of a DSM on the availability of US films, as opposed to the availability of European films throughout the EU.

3.4 Who Buys From Whom?

Our data naturally allows us to calculate trade statistics for our sample of films. Table 2 shows the share of 2013 box office revenue in each major destination to films from each major origin country. The table shows that US-origin films account for a large share of revenue in all destinations (72% on average). Other repertoires attracting substantial revenue include the France (4.3%), Germany (3.4%), and the UK (3%). These numbers, of course, describe the films traded into theaters, so they reflect both the availability documented above as well as the appeal of the repertoires.

We can use these figures to construct a measure of how much consumers in each destination country like imports from each origin country. Consider for instance the US row in Table 2. US consumers allocate 92.9% of their film consumption to their domestic products, while Spaniards allocate 77.3% of their film consumption to US films. The ratio 77.3/92.9 can therefore be used as a measure of the Spanish relative preference for US films. We can calculate this preference measure for each destination country and average them across destinations to obtain an indication of which origin films are preferred by consumers. Figure 4 describes this preference measure and shows clearly that US films are the most preferred by consumers, followed by productions from the UK.

We can similarly construct a measure of the preference for imported films in each destination. Looking again at Table 2 and considering, for instance, the UK column, we observe that 1.5% of their film consumption is allocated to Spanish films, while Spanish films account for 9% of Spanish consumption. The ratio 1.5/9 therefore gives a measure of UK consumers' preference for Spanish films relative to Spain's. Likewise, the ratio 84.2/92.9 gives the UK relative preference to US films. We can average these measures of relative preferences over the elements of the UK column to obtain the average UK preference for imported films. Figure 5 shows this measure for each importing country. Poland is the country with the highest average relative preference for imported films, followed by Austria and Portugal. The US stands out as the country with the lowest relative preference for imported films.

Our counterfactual simulations aim at measuring the implications of greater availability of films (in effect, liberalization of trade) on producers and consumers under certain configurations: autarky, a EU DSM, and worldwide frictionless trade. Figures 4 and 5 provide hints about the effects of this increase in availability. For instance, countries where consumers have a larger preference for imported products are likely to benefit more from increased trade. Similarly, we would expect that producers from origins whose films are most preferred by others gain more from increased trade. Compared to the autarky scenario, it is for example likely that US producers will greatly gain from trade given the important popularity of their films. When considering the implications of a European DSM, however, we should keep in mind that these preference measures should also be contrasted with the availability of products. For instance, while US films are mostly preferred by other countries' consumers and should therefore importantly benefit from increased trade, they are also the ones mostly available in the EU (see Figures 2 and 3), limiting the potential additional gains from a DSM.

4 Model

4.1 Demand

This section presents our model of demand for films in theaters. Following Berry (1994) and Ferreira et al. (2013), we employ a nested logit model of demand that allows us to easily infer films' quality while allowing for substitutability among films.[10] In each country and each month, consumers choose whether to go to the cinema and then choose among available films. The choice set of films varies both across countries and over time. We define J_{ct} as the set of films available in country c at time t, and index films by j. Suppressing time subscripts, each consumer therefore decides in each month whether to watch one film in the choice set $J_c = \{1, 2, 3, \ldots, J_c\}$ or not to go to the cinema and consume the outside good. More specifically, every month every consumer i in country c chooses j from the $J_c + 1$ options that maximizes the conditional indirect utility function

[10] See also Aguiar and Waldfogel (2014) for the case of music.

given by:

$$\begin{aligned} u_{ij} &= x_{jc}\beta - \alpha p_c + \xi_{jc} + \zeta_i + (1-\sigma)\epsilon_{ij} \\ &= \delta_{jc} + \zeta_i + (1-\sigma)\epsilon_{ij}, \end{aligned} \tag{1}$$

where δ_{jc} is the mean utility of film j in country c. The parameter ξ_{jc} is the unobserved (to the econometrician) quality of film j from the perspective of country c consumers and can differ across countries for the same film (film j can for example have different quality to US vs French consumers). ϵ_{ij} is an independent taste shock. In contrast to a simple logit model, the nested logit allows for correlation in consumer's tastes for consuming films.[11] This prevents the possibility that consumers have heterogeneous tastes, i.e. differ in their taste for consuming films. The parameter ζ_i therefore represents the individual-specific film taste common to all films in the nest. Cardell (1997) shows that if ϵ_{ij} is a type I extreme value, then this implies that the error term $\zeta_i + (1-\sigma)\epsilon_{ij}$ is also a type I extreme value. The parameter σ measures the strength of substitution across films in the choice set J_c. When $\sigma = 0$, the model resolves to the simple logit (see footnote 11) and the parameter ζ_i, the consumer-specific systematic film-taste component, plays no role in the choice decision. As σ approaches 1, the role of the independent shocks $(\epsilon_{i0}, \epsilon_{i1}, \ldots, \epsilon_{iJ})$ is reduced to zero and the within group correlation of utility approaches one. This implies that consumer tastes, while different for any consumer i across films, are perfectly correlated within consumer i across films.

Following equation (1) and normalizing the utility of the outside good δ_{0c} to 0, the market shares for all $j \in J_c$ are given by $S_{jc} = \frac{e^{\frac{\delta_{jc}}{1-\sigma}}}{D_{J_c}^{\sigma} + D_{J_c}}$, where $D_{J_c} = \sum_{j \in J_c} e^{\frac{\delta_{jc}}{1-\sigma}}$. Inverting out δ_{jc} from observed market shares as in Berry (1994) leads to:

[11] In the logit model the individual taste ϵ_{ij} is independent across both consumers and choices and the conditional indirect utility function is given by $u_{ij} = \delta_{jc} + \epsilon_{ij}$. This prevents the possibility that consumers have heterogeneous tastes, i.e. differ in their taste for consuming music.

$$\ln(S_{jc}) - \ln(S_{0c}) = \delta_{jc} + \sigma \ln\left(\frac{S_{jc}}{1 - S_{0c}}\right)$$
$$= x_{jc}\beta - \alpha p_c + \sigma \ln\left(\frac{S_{jc}}{1 - S_{0c}}\right) + \xi_{jc}, \tag{2}$$

It follows that estimates of β, α and σ can be obtained from a linear regression of differences in log market shares on film characteristics, prices, and the log of the within group share. In our estimations, x_{jc} will include a constant, GDP per capita (to control for unobserved heterogeneity in film tastes that is correlated with income), a set of year dummy variables, and a set of country dummy variables.

4.2 Consumer Surplus and Revenue

Once we obtain our estimates of β, α and σ, we can calculate the mean utility of each film j in each country δ_{jc}, and given these estimates we can calculate the consumer surplus (CS) and the revenue for any choice set configuration. The formula for the CS is given by:

$$CS_c = \frac{M_c}{\alpha} \ln\left(D_{J_c}^{1-\sigma} + 1\right). \tag{3}$$

The formula for the revenue generated in each destination country c is given by

$$Rev_c = p_c M_c \left[\frac{D_{J_c}}{\left(D_{J_c}^{\sigma} + D_{J_c}\right)}\right]. \tag{4}$$

Note that revenue accrues to origin country producers whose films are available in each destination country. We therefore compute the revenue for each set of origin-specific producers as the sum of the origin country share in each destination weighted by the destination market sizes.

4.3 Identification and Estimation Results

The parameter σ plays a crucial role in our demand model as it measures the degree of substitutability among different films. Intuitively, it depends on how the total inside share of films changes as the number of films in the choice set varies. If the level of substitutability is high (σ close to 1), then the total inside share will not vary much as additional films will cannibalize other films' shares. On the other hand, if the substitutability is low (σ close to 0), adding new films to the choice set will increase the total inside share of films (market expansion).

The inside share of each film j, S_{jc}, is by construction endogenous in equation (2), so we need to find an instrument in order to consistently estimate σ. We follow the widely used assumption from Berry et al. (1995) that product characteristics are exogenous, and since we observe variation in the number of films available over time and across markets, we can use the total number of films as an instrument. In particular, we will use the log of the number of films in each country-year as an instrumental variable to identify σ. Figure 6 shows how, for the year 2013, there is a positive relationship between the number of films in a given country and the share of the population consuming films (the inside share of films).[12] Since σ relates to how the inside shares change with the number of films available in a market changes, we can expect substantial benefits from additional films and therefore an estimate of σ that is lower than 1.

Table 3 reports estimates of the demand model (2). Note that we treat price as exogenous throughout because it is the average price across movies set by movie theaters and not the movie-specific price. Columns (1) and (2) present OLS results. Both specification include year fixed effects and control for per-capita levels of gdp. Specification (2) additionally controls for country fixed effects. Estimates of σ are close to 1 in the OLS estimations, reflecting the fact that we are regressing a function of $\ln(S_{jc})$ on another function of $\ln(S_{jc})$. Specifications (3) and (4) use the logarithm of the number of prod-

[12] For each country c, the total inside share is defined as $S_{Jc} = \frac{1}{M_c}\sum_{j \in J_c} q_{jc}$, where M_c is a measure of market size and q_{jc} is the number of admissions for film j in country c. For each country c, we define market size as 12 times its population.

ucts as instrument to consistently estimate σ. We find an estimate of σ equal to 0.669 in specification (3). When additionally controlling for country fixed effects, this estimate is equal to 0.88. The price coefficients are similar in specifications (3) and (4). Because the last specification (4) gives the highest estimate of σ, it will also provide the most conservative estimate of the gains from trade liberalization. We will therefore use these demand estimates for our counterfactuals.

5 Simulations

Our main goal is to simulate the effect of a EU DSM via a comparison of the current situation - involving territorial fragmentation and distribution restrictions (the status quo) - and a European DSM in which all films available somewhere in the EU are also available everywhere else in the EU.

We note the important distinctions between our counterfactual simulations - which involve theatrical distribution - and the ideal counterfactual scenario we would like to simulate - a DSM in a context with digital distribution. First, our simulation should be interpreted as the elimination of any barriers to trade within the EU for theatrically released films only. This means that we are not able to directly estimate the effects of a EU DSM in an environment that includes the long tail of films (i.e. films that would not be released in theaters but that would be available in digital format). Second, while the set of films that become available under our simulation of a DSM is limited by our theatrical data, we implicitly assume that theatrical capacity constraints are not binding. In other words, we assume that theaters in every country are able to sustain the greater number of films that a EU DSM would deliver. Finally, our simulations only allow us to estimate the effect of making current films available everywhere in the EU. This is because the theatrical data only allow us to estimate the contemporary appeal of films (i.e. in the year that they are released) for a given calendar year, and not the appeal of older films. This is in contrast with a EU DSM under digital distribution, which would permit access not only to currently available films in digital format, but also to older films.

In sum, our counterfactuals do not allow us to make a direct estimation of the magnitude of the effect of a EU DSM with digital distribution. They do, however, allow us to understand how film producers from different countries would be affected by a policy resembling a DSM in the sense of broadly similar changes in repertoire availability. In particular, they allow us to understand whether - for each origin country of production - the gains from reaching a larger set of foreign consumers offset the negative effect of facing more competition in their home market.

For comparison, we also simulate autarky (in which only domestic films are available in each country) as well as worldwide frictionless trade (in which all films are available in all destinations). We perform all of our counterfactuals using the data for the year 2013. Since we only have data on 17 EU countries with all the necessary information to construct our welfare measures (e.g. data on ticket prices), our counterfactual calculations are limited to this subset of EU Member States only.

5.1 Predicting the Appeal of Untraded Films

Simulating the trade patterns that would arise from a DSM requires predictions of the quality of each European-sold film in every European destination. For instance, of the 2,129 distinct films exhibited in our 23 countries in 2013, only 335 are observed to be sold in Germany. We therefore need an estimate of the 1,794 remaining films' quality had they been traded in Germany. While this is in principle difficult, we can get substantial guidance from the data. It turns out that the appeal of films is very similar across countries. Denote the appeal of each traded film j in each destination c in which it appears as δ_{jc}. Figure 7 shows a scatter plot of $\delta_{jGermany}$ against δ_{jSpain} for films appearing in the choice set of both countries, together with a best-fit line and a 45° line. The positive relationship between the appeals of films in both countries indicates that films that are more popular in Spain are also generally more popular in Germany. We can therefore rely on an estimate of the relationship between the appeal of films traded in both Germany and Spain to predict the appeal of films that are not traded in Germany but that are traded in Spain. Following Ferreira et al. (2013) and Aguiar and Waldfogel (2014), we

can regress δ_{jc} on $\delta_{jc'}$ to obtain a measure of the relationship between films' appeal across each country pair c, c'. Since we observe box-office revenue in up to 50 destination countries, we can potentially rely on films' appeal in up to 49 countries to construct estimates of their appeal in each country in question. For instance, if film j is not sold in Germany but sold in the remaining 49 countries, we can rely on its estimated appeal δ_{jc} in these 49 destinations to construct 49 distinct forecasts of its appeal in Germany. Figure 7 would provide one of these estimates, based on the relationship between films' appeal in Germany and Spain. Averaging these 49 forecasts would provide us with a single measure of the film's predicted appeal in Germany. One potential problem we are facing is that many films only trade in a limited number of countries, therefore providing us with limited information to construct our forecasts. Consider a particular film j that only sells in Spain. To construct a forecast of film j's appeal in Germany, we can only rely on the relationship between films' appeal across Germany and Spain (see Figure 7). We are concerned that relying on a single forecast could result in poor predictions of appeal in countries where the films are not traded. As it turns out, the potential relevance of this concern is not negligible; of the 2,129 distinct films exhibited in our 23 countries in 2013, 68% (1,462 films) are exhibited in a single destination. To alleviate this concern, we decided to construct predicted measures of appeal only for films that were exhibited in at least 2 countries.[13] Our counterfactual simulation of a DSM will therefore not allow us to include all films in the DSM choice set, but only films that were exhibited in at least two distinct countries.[14]

One concern is that non-traded films may constitute a selected sample. In particular, it may be that whether these films are traded to a particular destination is correlated with more than simply their appeal in another destination. To alleviate that concern, we include dummies for whether the film appears in each of the other countries in our forecasting model. In other words, if T_{tc} is an indicator for whether a particular film

[13] In 2013, the films that were exhibited in a single country account for about 12% of overall yearly box-office revenue.

[14] We illustrate the consequence of including all films in our counterfactual simulations (i.e. including forecasts for films that are only exhibited in a single country) in Appendix B. Figures B.14-B.17 show that including these forecasts – and compared to other alternative choice sets – indeed leads to abnormal results.

appears in destination country c in year t, we run the following regression for each pair of countries c and c':

$$\delta_{jtc} = A_{cc'} + B_{cc'}\delta_{jtc'} + \sum_{s \neq c,c'} \tau_s T_{ts} + \lambda_t + \mu_{jtc}, \tag{5}$$

where λ_t is a set of year dummies. For film j which is not traded in country c (e.g. Germany) but is traded in some other countries, we construct an estimate of δ_{jc} as the average of the predicted δ_{jc} from the regressions for each c' in which the film is traded. Once these estimates are computed, we end up with a measure of appeal (either directly obtained from our demand estimation or predicted from the above forecasting model) for each film in each country. This allows us to calculate the CS and revenue for any specific choice set.

5.2 Counterfactual Results

We use the estimated demand model to perform three simulation exercises. We start with autarky, in order to calculate the gains from status quo trade. We then turn to the main objective of the paper and simulate a European Single Market where all films available somewhere in the EU are also available everywhere else in the EU. Finally, we also consider the case of worldwide frictionless trade, where all films are made available everywhere.

For all of our counterfacual statistics, we calculate standard errors by bootstrapping using the following procedure. The results from our demand estimation in column (4) of Table 3 provides us with the estimated distribution of σ and α. By taking random draws from this distribution, we can compute alternative simulation statistics (i.e. CS and revenue). That is, for each draw σ_d and α_d, we can compute a new vector of mean utilities $\delta_d(\sigma_d)$ for songs that are currently traded. For the non-traded songs, we follow the same procedure as above to forecast their mean utility in destinations where they are not currently traded - see equation (5). Once equipped with the full vector of mean utilities and the draw-

specific parameter α_d, we can calculate the corresponding levels of CS and revenue for this specific draw. We repeat this exercise 100 times to obtain distributions of the CS and revenue under the different simulation regimes.

5.2.1 The Gains from Trade

We first simulate autarky in order to calculate the status quo gains from trade. Under autarky, consumers face choice sets composed of films originating from their home country only. We therefore remove all imported films from each countr's choice set and then calculate the corresponding consumer surplus. Similarly, we compute producers' revenue as the revenue generated in their own country. The status quo gains are then given by the difference between the status quo and autarky levels of CS and revenue.

The results of our simulation are reported in Tables 4 and 5 below, along with their standard errors, computed as explained above. To facilitate comparisons across countries, we report these measures in per capita terms in Figures 8 and 9. The gains to consumers will naturally depend on two factors. First, countries that import a lot under the status quo will naturally be hurt more by autarky. As Figure 8 shows, CS gains are generally larger for countries where domestic films account for a smaller share of consumption (see Table 2). This is particularly true for the UK, whose consumption relies heavily on US films and where domestic films account for only 8.8% of overall consumption. UK consumers gain about 4.4 euros per capita from trade, while Austrian consumers – who also rely little on their domestic films – gain 4.1 euros. Second, the gains from trade will also depend on the extent to which consumers from a given country like films from abroad. Given that US consumers rely heavily on US films for their consumption, it is not surprising that their gains from trade are relatively low (less than 25 cents per capita).

While consumers naturally benefit from trade everywhere, the effects of trade on producers are a priori undetermined. Trade helps producers reach foreign consumers, but it also exposes them to more competition in their home market. The net effect of these two opposing forces will depend on the appeal of an origin's set of films in foreign markets as well as on the preferences of the country's consumers for foreign products (see Figures 4

and 5). Figure 9 shows the effects of trade on the different producers. The US producers turn out to be the only producers to benefit from trade, with 17 euros per capita gains. These large gains are not surprising given the important share of domestic consumption that US films account for in every destination country and the high relative preference for US films (see Table 2 and Figure 4). All the remaining countries are hurt by trade, with losses ranging from a about 1.6 euros per capita for Bulgaria to up to 11.7 euros per capita in the case of Denmark.

While our model does not explicitly incorporate a supply side, the revenue results give clear indications about the effect of trade on supply. Under autarky, US producers would get less revenue; hence their investment would contract. Other producing countries would earn more revenue under autarky and would therefore expand their investment.

5.2.2 European Digital Single Market

We now turn to the simulation the effect of a European DSM, where all films available somewhere in the EU are also made available everywhere else in the EU. We summarize the impacts of a DSM by calculating the per capita change in CS and revenue from a DSM compared with the status quo.[15] By construction, consumers gain in all countries because a DSM increases the number of films available in each destination. We expect large gains in countries with few films exhibited locally. As we saw in Table 1, the smaller EU countries have under 150 films per year, whereas the larger EU countries have roughly 300, and the US has over 500. Hence, we expect bigger gains in CS from a DSM in the smaller countries. Note that the US and the countries that are outside the EU will witness no change in their CS from a DSM because it does not affect the number of films available to consumers outside the EU.

Table 4 and Figure 10 show the effects of a DSM on consumers. As expected, smaller countries' consumers gain rather importantly following a unique European market. France is an exception, with gains of 0.45 euros per capita. We note that this finding is rather

[15] As discussed in Section 5, we only consider the European availability of products for which we are able to construct a sensible measure of predicted appeal. This includes films that are available in at least two distinct countries under the status quo.

surprising given the rather high share of French consumption accounted for by domestic films (see Table 2). The country benefiting less is Germany, with gains of about 6 cents. European consumers would gain an average of 23 cents per capita (an increase of 1.8% compared to the status quo).

Effects on revenue can differ across countries. As known from the descriptive results from Section 3, a DSM will increase the availability of small-country repertoires more than large country EU repertoires. Hence, we expect larger positive effects for small EU countries. By contrast, we expect much smaller and even possibly negative effects for the US and for countries whose repertoire is already widely available. We calculate revenue per person in the origin country, and Table 5 and Figure 11 show the changes in revenue by country. The increases in revenue are largest for small EU countries: close to 5.8 euros per capita for 2013 for the Czech Republic, and close to 3 euros for Sweden. Revenue effects in the large EU countries are smaller: around 1.2 euros for Germany, 50 cents for the UK, and about 20 cents for Spain. The negative effects of enhanced competition seem to dominate the positive market expansion effect for Italian and French producers, whose revenue falls about 50 and 4 cents, respectively. European producers therefore gain by an average of 46 cents per capita (an 11% increase in revenue compared to the status quo). US producers, on the other hand, would lose about 78 cents per capita from the creation of a EU DSM (a 1.8% decrease in revenue compared to the status quo).

These results stand in rather stark contrast to the concerns voiced by practitioners, such as the exhibitor quoted above who likened DSM to an "invasion of American products" that would "kill European audiovisual culture and diversity." Instead, it appears that sellers from countries outside the US, whose availability is stimulated, gain the most from a European DSM.

5.2.3 Worldwide Frictionless Trade

The DSM trade liberalization under discussion raises revenue to most European countries while reducing revenue to the US. How about larger-scale liberalization? We explore this

by placing all products in all destinations.[16] Figure 12 shows the changes in consumer surplus by country. Unsurprisingly, we can again observe that accessing the worldwide catalogue of films would again mostly benefit smaller countries' consumers. France is again an exception with a relatively large per-capita gain of 0.46 euros. Consumers in Denmark also gain about 46 cents from worldwide frictionless trade, while German consumers gain less than 10 cents.

Figure 13 shows the effects of worldwide liberalization on producers. The effects of this policy are similar to the European DSM, except that the US loses more revenue, and the EU countries that gain under DSM experience larger gains. Finally, France now gains revenue under frictionless film trade - about 1.3 euros - and Italian producers now only lose around 30 cents.

6 Conclusion

We have developed a model of world film demand for simulating the effects of greater availability of films in Europe on the consumers and producers in various countries around the world. By construction, greater availability raises the well-being of consumers, since our model does not allow for any products to be withdrawn when they face greater competition. Our findings for revenue are more nuanced. Our main revenue finding is that a digital single market would increase revenue for most European producing countries (and for Europe as a whole), while reducing the revenue of the US. This finding is lent substantial plausibility by the data on availability of films prior to DSM. US films are already widely available in Europe, while European films are far less available in Europe. Of the US films now available in at least one EU country, they are one average available in countries accounting for 46 percent of European GDP. The corresponding figure for European films is 16 percent. Hence, DSM would do more for the availability of EU repertoire than for the US. The main impact of DSM, in our simulations, is to provide additional competition for ubiquitously available US films.

[16] We again only consider full availability of products for which we are able to construct a sensible measure of predicted appeal. See footnote 15.

We still anticipate a few important extensions to our analysis. First, we need to improve our forecasting model to potentially correct for the fact that some films are only traded in a limited set of destinations. Second, it would be desirable to extend our current partial equilibrium approach to allow for entry responses that alternative choice sets would likely engender. Finally, our study proceeds using data on films distributed in theaters, while we would like to make predictions about a context with digital distribution (and therefore unconstrained by theatrical availability). To the best of our knowledge, data on sales of films through digital channels are difficult to obtain, so it is challenging to compare patterns of consumption in theatrical and digital channels. Still, in future work it would be desirable to develop indirect measures of digital consumption. One approach is to compare patterns of film availability on digital platforms across countries. A second approach would be to proxy demand for digitally distributed films using search intensity at Google. Both of these approaches have the virtue of likely feasibility.

References

Aguiar, L. and J. Waldfogel (2014): "Digitization, Copyright, and the Welfare Effects of Music Trade," JRC Working Papers on Digital Economy 2014-05, Joint Research Centre (Seville site).

Berry, S., J. Levinsohn, and A. Pakes (1995): "Automobile Prices in Market Equilibrium," *Econometrica*, 63, 841–90.

Berry, S. T. (1994): "Estimating Discrete-Choice Models of Product Differentiation," *RAND Journal of Economics*, 25, 242–262.

Cardell, N. S. (1997): "Variance Components Structures for the Extreme-Value and Logistic Distributions with Application to Models of Heterogeneity," *Econometric Theory*, 13, 185–213.

European Commission (2015): "A Digital Single Market Strategy for Europe," Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions COM(2015) 192 final, European Commission.

Ferreira, F., A. Petrin, and J. Waldfogel (2013): "Trade, Endogenous Quality, and Welfare in Motion Pictures," Working paper.

Gomez, E. and B. Martens (2015): "Language, copyright and geographic segmentation in the EU Digital Single Market for music and film," JRC Working Papers on Digital Economy 2015-04, Directorate Growth & Innovation and JRC-Seville, Joint Research Centre.

Renda, A., F. Simonelli, G. Mazziotti, A. Bolognini, and G. Luchetta (2015): "The Implementation, Application and Effects of the EU Directive on Copyright in the Information Society," CEPS Special Report 120, Centre for European Policy Studies.

Telang, R. and J. Waldfogel (2014): "Piracy and New Product Creation: A Bollywood Story," Tech. rep.

Waldfogel, J. (2016): "Cinematic Explosion: New Products, Unpredictability, And Realized Quality In The Digital Era," *Journal of Industrial Economics*.

A Figures and Tables

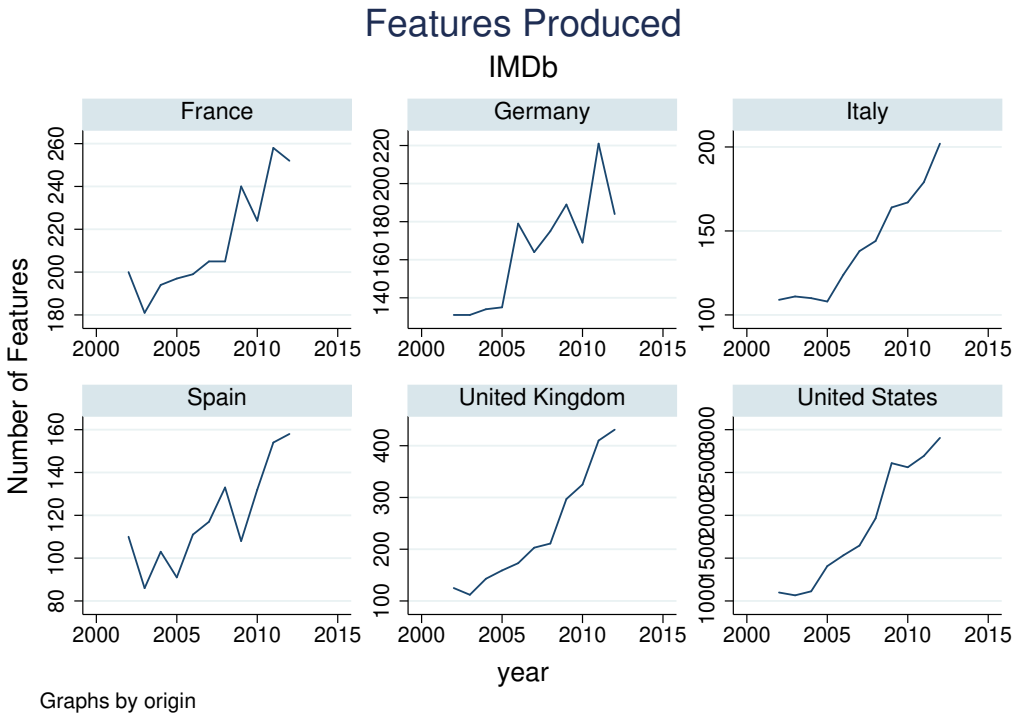


Figure 1a: Film production, by country.

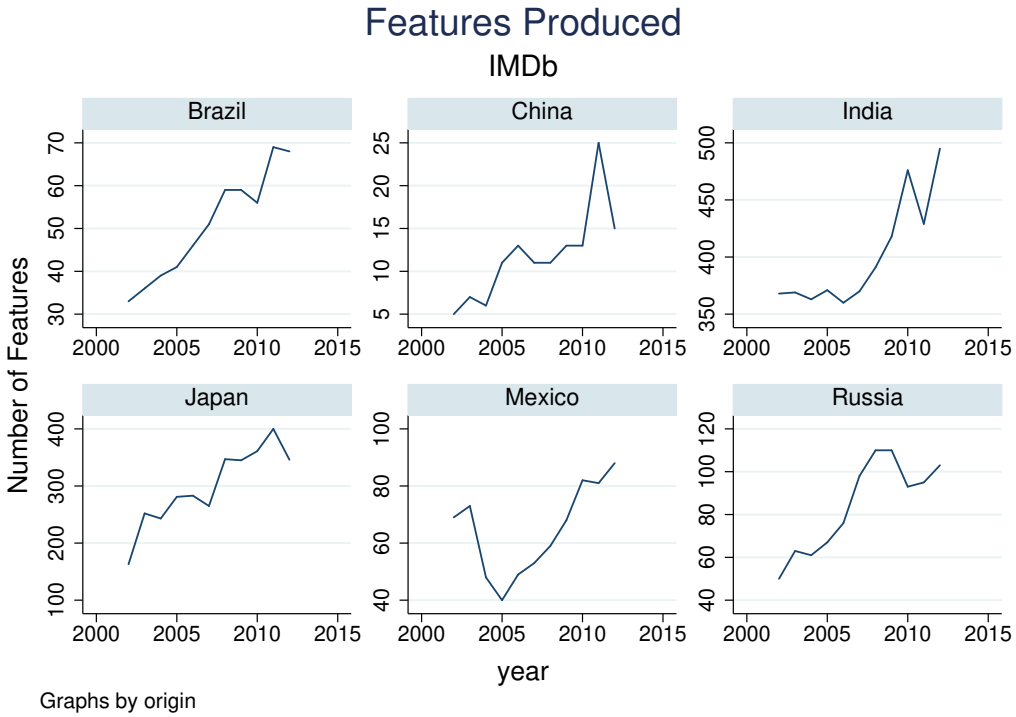


Figure 1b: Film production, by country.

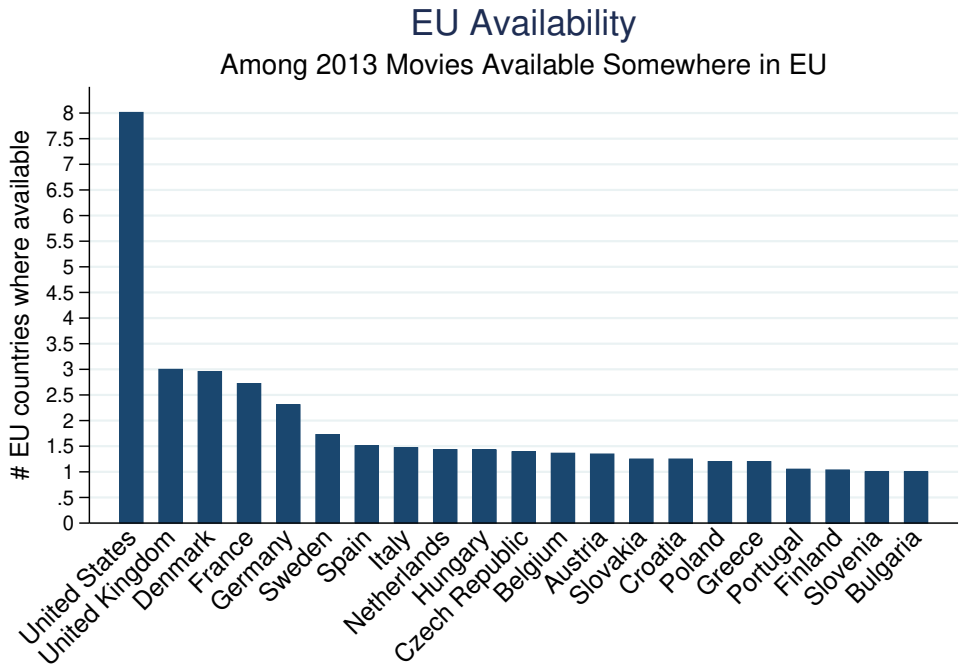


Figure 2: Average film availability within the EU, by country.

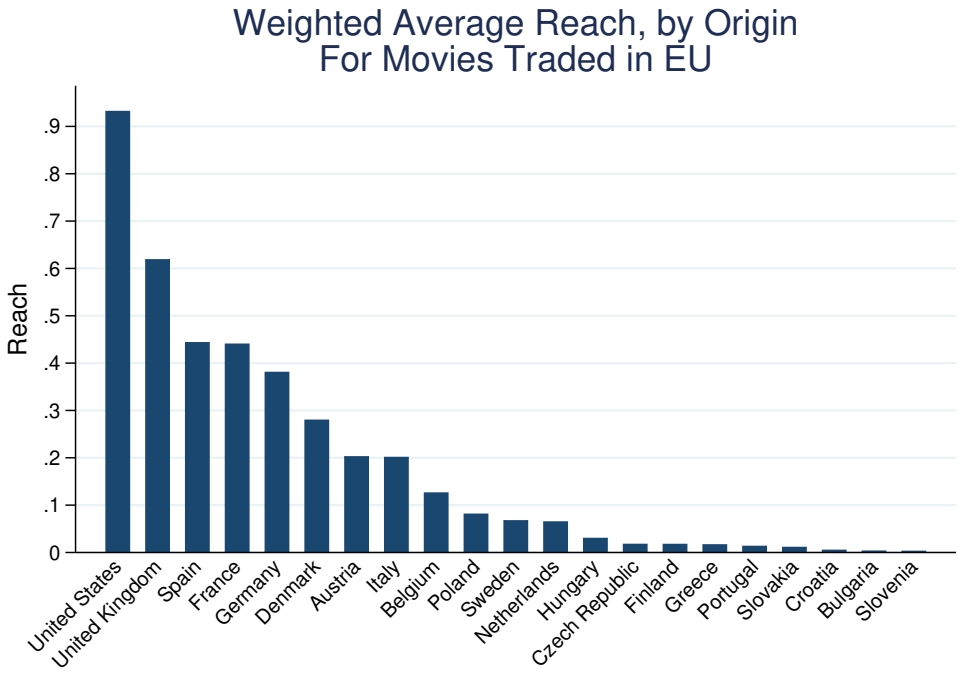


Figure 3: Average film reach, by producing country.

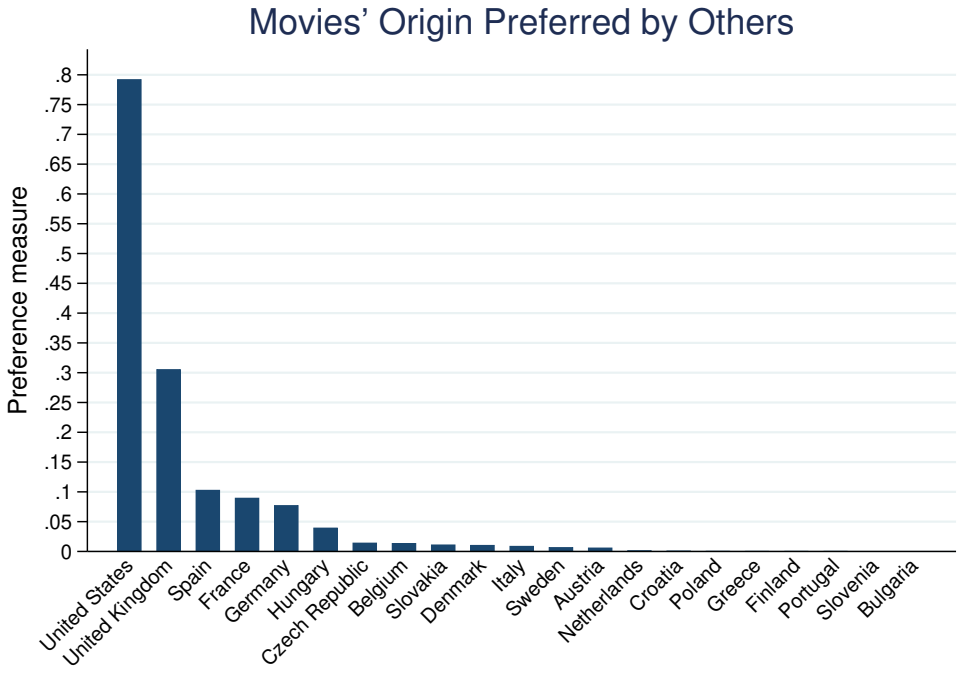


Figure 4: Which films are preferred by others?

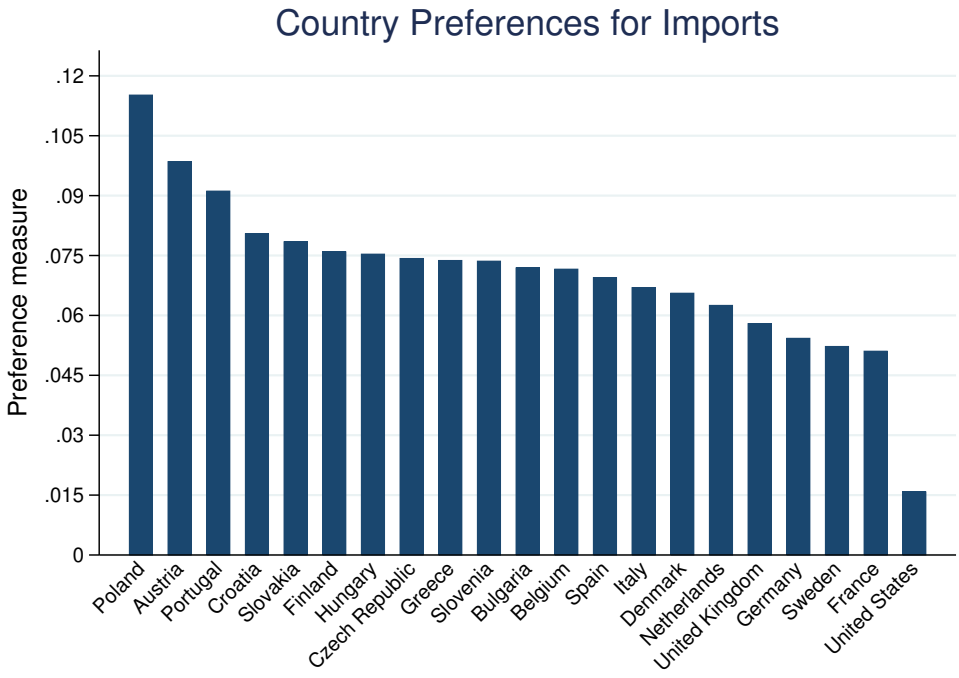


Figure 5: Relative preferences for imported films.

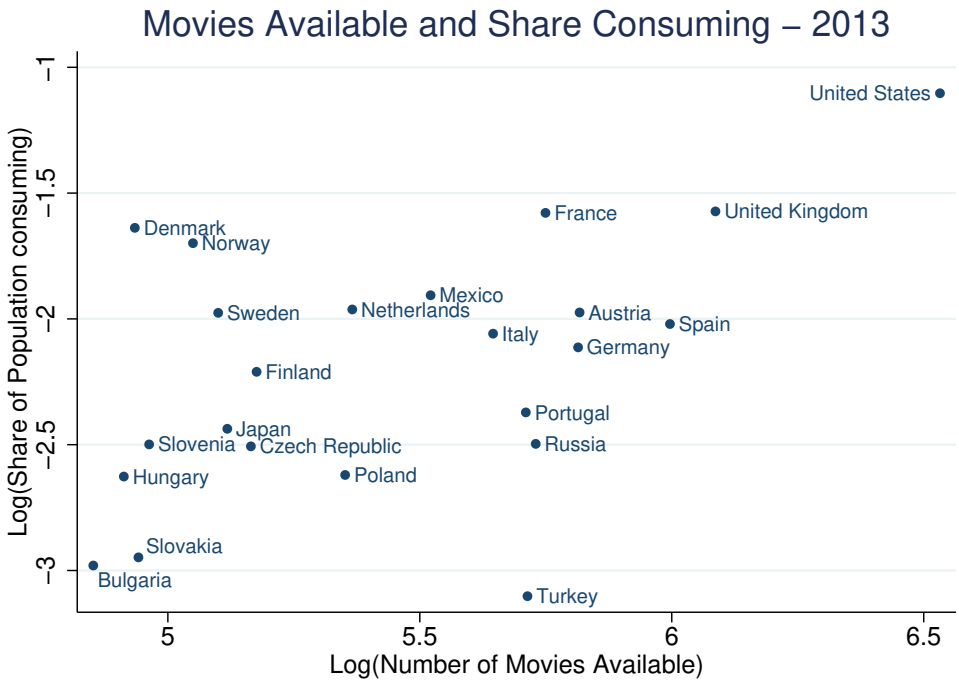


Figure 6: Demand model identification.

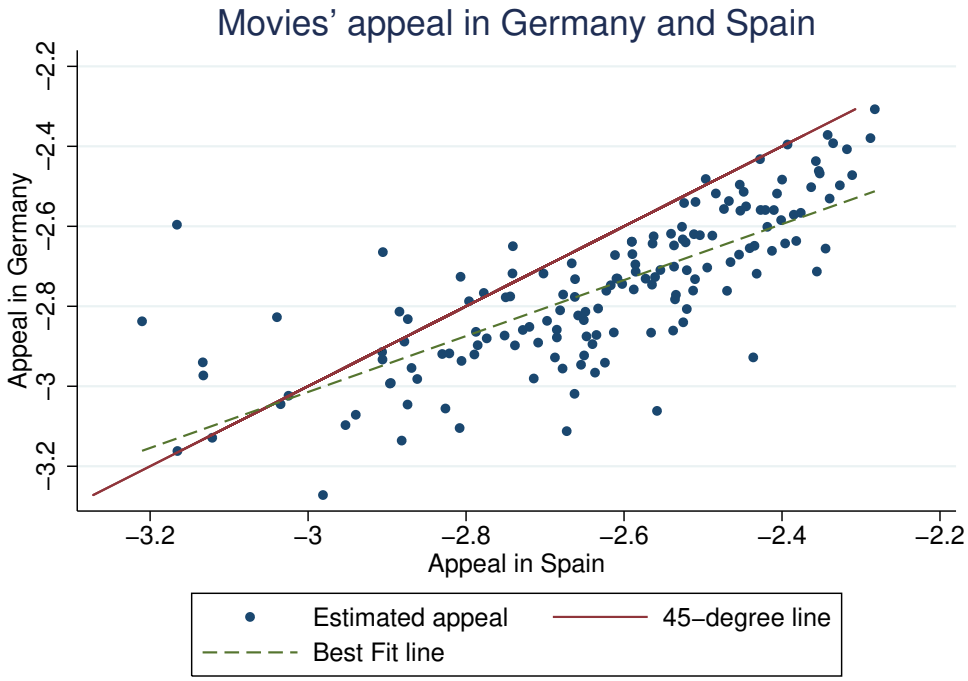


Figure 7: Cross-country relationship between film's appeal: Germany vs Spain.

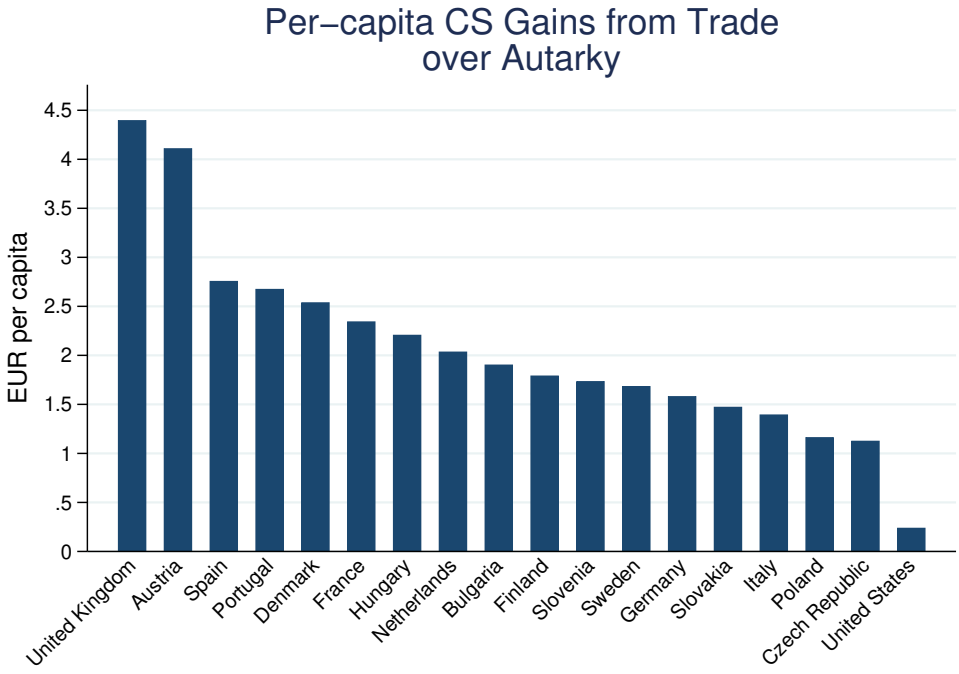


Figure 8: Changes in per-capita CS: status-quo trade over autarky.

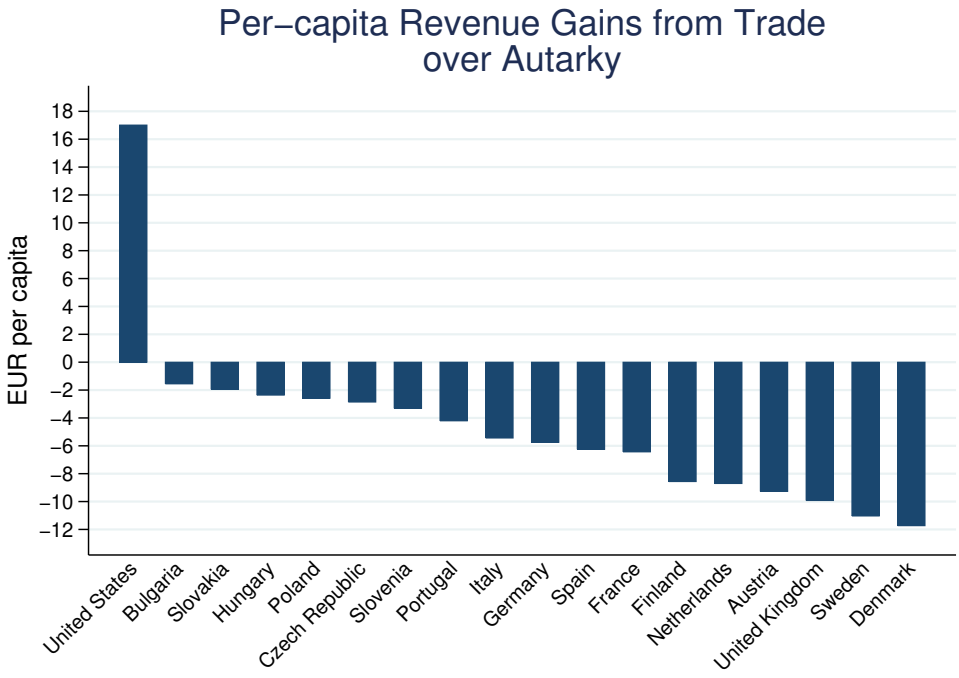


Figure 9: Changes in per-capita revenue: status-quo trade over autarky.

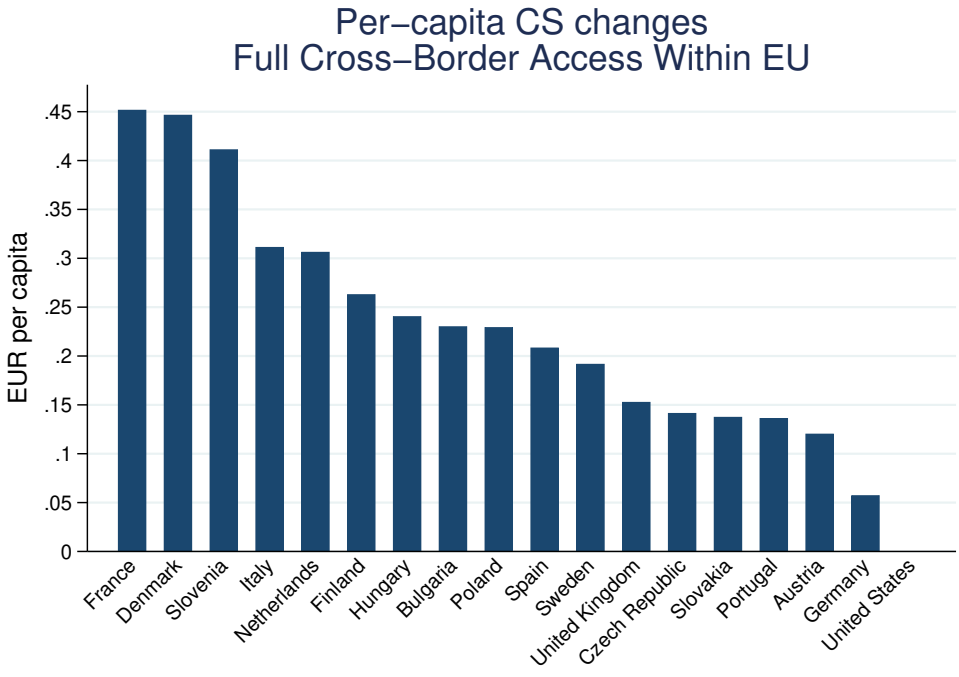


Figure 10: Changes in per-capita CS: EU-DSM over status-quo.

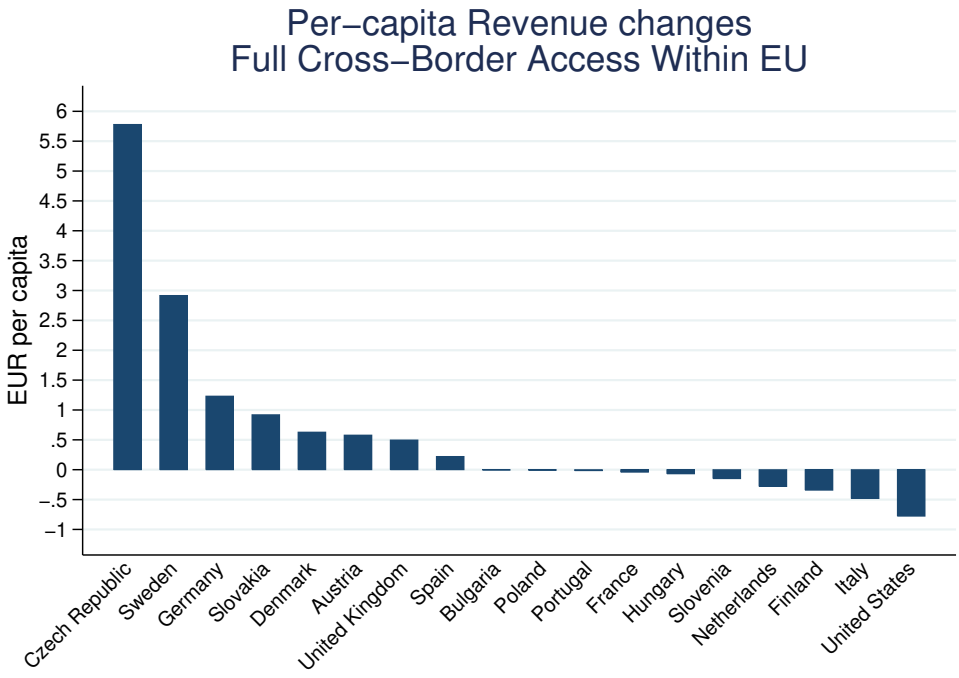


Figure 11: Changes in per-capita revenue: EU-DSM over status-quo.

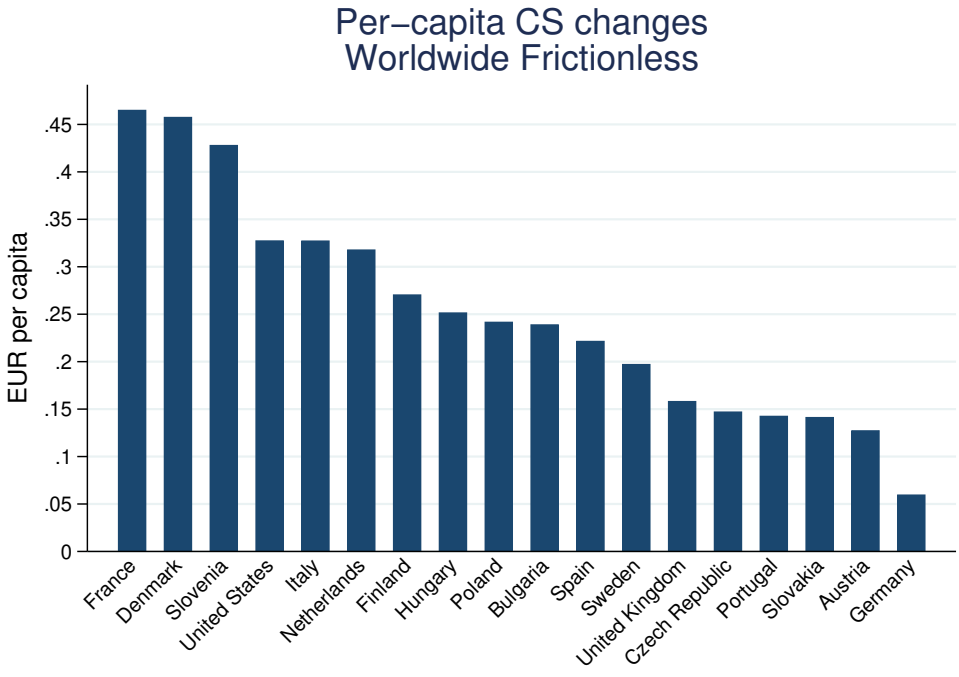


Figure 12: Changes in per-capita CS: worldwide frictionless trade over status-quo.

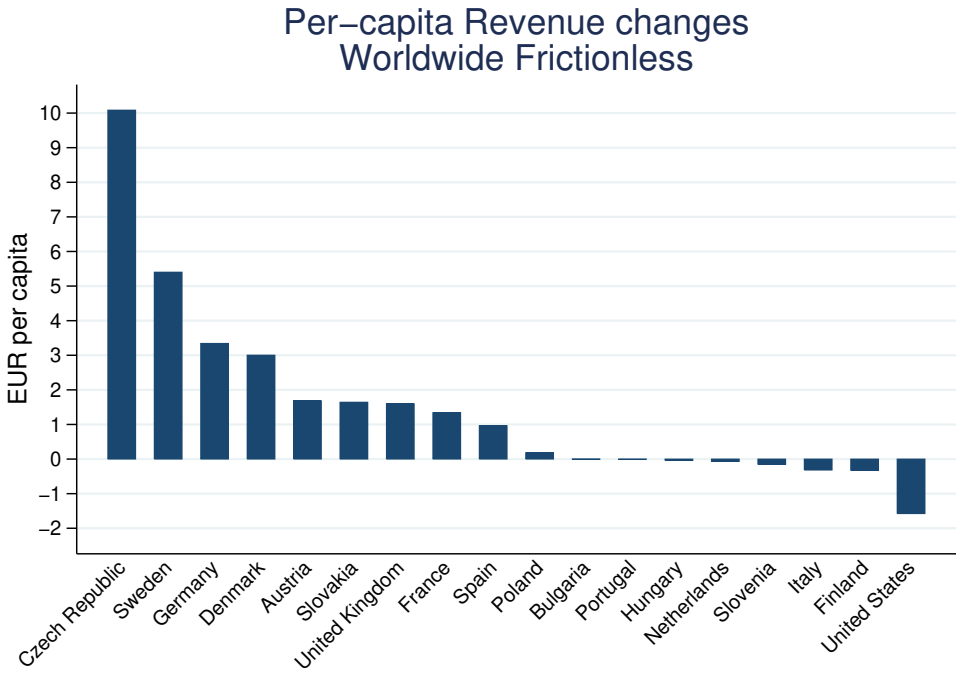


Figure 13: Changes in per-capita revenue: worldwide frictionless trade over status-quo.

Table 1: Films Available in Theaters in 2013.

Country	Number	Share of local Films	Share of Total Films in EU20
United States	687	0.661	
United Kingdom	440	0.180	0.304
Spain	402	0.276	0.277
Belgium	377	0.074	0.260
Austria	336	0.119	0.232
Germany	335	0.221	0.231
France	314	0.331	0.217
Portugal	302	0.060	0.208
Italy	283	0.194	0.195
Netherlands	214	0.126	0.148
Poland	211	0.133	0.146
Finland	177	0.141	0.122
Czech Republic	175	0.120	0.121
Croatia	169	0.024	0.117
Sweden	164	0.152	0.113
Greece	159	0.031	0.110
Slovenia	143	0.014	0.099
Slovakia	140	0.021	0.097
Denmark	139	0.115	0.096
Hungary	136	0.022	0.094
Bulgaria	128	0.039	0.088

Table 2: Who Buys From Whom?

	Destination																
Origin	AT	BE	CZ	DE	DK	ES	FI	FR	IT	NL	NO	PT	SE	SI	UK	US	Rest
AT	2.61	0.05	0.00	0.14	0.04	0.04	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.00
BE	0.03	10.63	0.00	0.18	0.13	0.01	0.15	0.68	0.04	0.00	0.00	0.00	0.00	0.96	0.14	0.00	0.10
CZ	0.00	0.00	21.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
DE	15.24	1.24	1.16	23.64	2.68	2.64	0.90	0.86	1.40	0.96	0.78	1.27	0.55	0.65	0.47	0.53	1.27
DK	0.11	0.23	0.89	0.11	23.91	0.40	0.39	0.26	0.11	0.19	0.33	0.17	0.49	0.19	0.20	0.03	0.13
ES	0.09	0.68	0.77	0.08	0.58	9.02	0.54	0.43	1.31	1.15	0.72	2.61	0.15	0.60	1.50	0.01	0.74
FI	0.00	0.00	0.00	0.01	0.00	0.00	15.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FR	2.40	7.81	1.74	1.89	1.30	3.28	2.46	29.18	2.60	2.10	0.61	8.65	0.87	1.30	1.15	1.15	1.41
IT	0.08	0.26	0.32	0.08	0.00	1.00	0.00	0.03	30.50	0.90	0.00	0.50	0.00	0.02	0.09	0.03	0.09
NL	0.01	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO	0.09	0.00	0.08	0.08	3.51	0.01	0.00	0.00	0.00	0.00	18.21	0.00	0.00	0.00	0.00	0.00	0.00
PT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.91	0.00	0.00	0.00	0.00	0.00
SE	0.02	0.03	0.06	0.03	1.14	0.25	1.39	0.01	0.09	0.01	2.05	0.03	26.47	0.03	0.01	0.00	0.01
SI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.50	0.00	0.00	0.00
UK	3.89	1.65	2.74	1.67	3.02	2.24	4.51	1.59	3.65	2.04	1.30	2.81	2.02	3.27	8.78	2.18	1.99
US	72.03	73.35	66.21	68.89	62.51	77.33	68.63	63.06	57.19	68.20	74.32	77.80	67.32	78.91	84.16	92.94	58.55
Rest	3.37	3.63	4.46	3.20	1.17	3.76	5.14	3.90	3.10	4.41	1.68	3.25	2.14	5.58	3.50	3.13	35.69
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

† Each cell from the table presents the percentage of 2013 total box office revenue in a given destination accounted for by movies from the corresponding origin country.

Table 3: Demand Estimation.[†]

	(1) Coef./s.e.	(2) Coef./s.e.	(3) Coef./s.e.	(4) Coef./s.e.
$\ln(\frac{s_j}{1-s_0})$	0.943***	0.999***	0.669***	0.880***
	(0.01)	(0.00)	(0.03)	(0.04)
Price	-0.164***	-0.099***	-0.105***	-0.111***
	(0.02)	(0.02)	(0.02)	(0.02)
GDP per capita	0.050***	0.017***	0.035***	0.019***
	(0.00)	(0.00)	(0.00)	(0.00)
Country Fixed Effects	✗	✓	✗	✓
Instruments	-	-	ln(N)	ln(N)
R^2	0.941	0.995	0.864	0.983
No. of Obs.	82299	82299	82299	82299

[†] All specifications include year fixed effects. Specification (1) and (2) use OLS. Specifications (3) and (4) use ln(number of products) as instrument. Standard errors are clustered on country-year level and are in parenthesis.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

Table 4: Annual Changes in Consumer Surplus[†]

Country	SQ	AUT	FT	ESM	ΔAUT	ΔESM	ΔFT
Austria	10.70	16.16	16.32	16.33	4.11	0.12	0.13
	2.70	2.77	2.79	2.79	1.26	0.04	0.04
Bulgaria	3.11	5.63	5.94	5.95	1.90	0.23	0.24
	0.96	0.97	1.00	1.00	0.55	0.08	0.09
Czech Republic	7.70	9.20	9.38	9.39	1.12	0.14	0.15
	1.50	1.58	1.60	1.60	0.37	0.05	0.05
Denmark	20.00	23.37	23.96	23.97	2.54	0.45	0.46
	3.83	4.01	4.07	4.08	0.85	0.16	0.16
Finland	10.18	12.56	12.91	12.92	1.79	0.26	0.27
	2.05	2.16	2.19	2.19	0.59	0.09	0.10
France	21.87	24.98	25.58	25.59	2.34	0.45	0.46
	4.10	4.29	4.35	4.35	0.79	0.16	0.17
Germany	11.83	13.93	14.00	14.00	1.58	0.06	0.06
	2.28	2.39	2.40	2.40	0.53	0.02	0.02
Hungary	5.19	8.12	8.44	8.45	2.21	0.24	0.25
	1.36	1.39	1.43	1.43	0.67	0.09	0.09
Italy	12.91	14.76	15.17	15.20	1.39	0.31	0.33
	2.42	2.53	2.58	2.58	0.47	0.11	0.12
Netherlands	13.67	16.37	16.78	16.79	2.03	0.31	0.32
	2.68	2.81	2.85	2.86	0.67	0.11	0.11
Poland	6.63	8.17	8.47	8.49	1.16	0.23	0.24
	1.34	1.40	1.44	1.44	0.38	0.08	0.09
Portugal	7.04	10.59	10.77	10.78	2.67	0.14	0.14
	1.77	1.82	1.84	1.84	0.82	0.05	0.05
Slovakia	3.87	5.83	6.01	6.01	1.47	0.14	0.14
	0.97	1.00	1.02	1.02	0.45	0.05	0.05
Slovenia	6.97	9.27	9.82	9.84	1.73	0.41	0.43
	1.52	1.59	1.66	1.66	0.55	0.15	0.15
Spain	11.72	15.38	15.66	15.68	2.75	0.21	0.22
	2.52	2.64	2.67	2.67	0.88	0.07	0.08
Sweden	13.90	16.13	16.39	16.40	1.68	0.19	0.20
	2.64	2.77	2.80	2.80	0.56	0.07	0.07
United Kingdom	19.30	25.14	25.34	25.35	4.39	0.15	0.16
	4.13	4.32	4.34	4.34	1.42	0.05	0.06
United States	43.28	43.60	43.60	44.03	0.24	0.00	0.33
	7.46	7.49	7.49	7.53	0.08	0.00	0.12

[†] All figures are in € per capita. SQ, AUT, ESM, and FT indicate Status Quo, Autarky, European Single Market, and worldwide Frictionless Trade regimes, respectively. ΔAUT indicates the change in CS of going from autarky to the Status quo. ΔESM and ΔFT indicate the change in CS of going from the Status Quo to the ESM and FT regimes, respectively. For each country the standard errors are in indicated in the second row and computed via bootstrapping as described in the text.

Table 5: Annual Changes in Revenue[†]

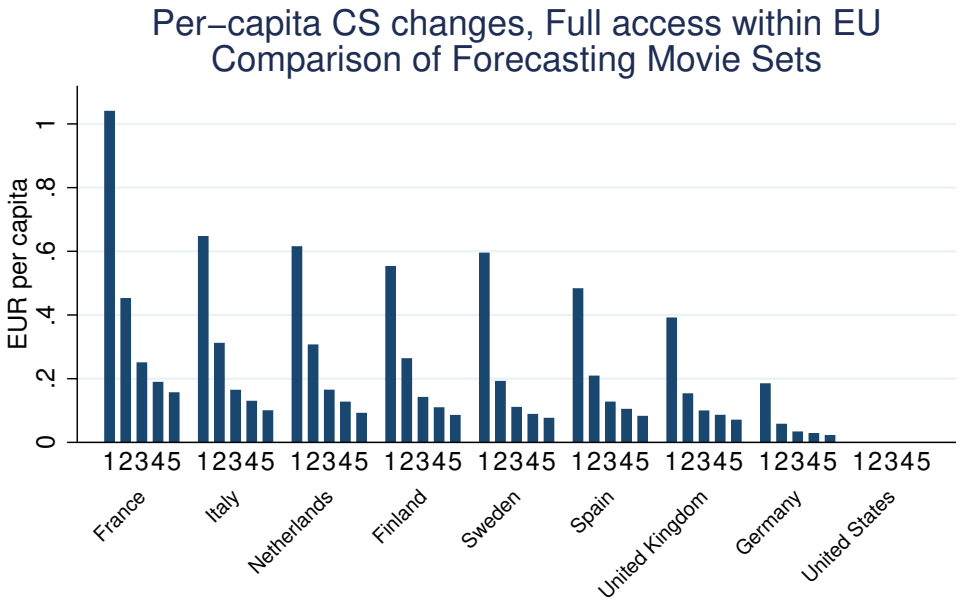
Country	SQ	AUT	FT	ESM	ΔAUT	ΔESM	ΔFT
Austria	13.19	0.87	1.64	3.10	-9.27	0.58	1.68
	1.76	0.00	0.01	0.02	1.32	0.01	0.01
Bulgaria	2.09	0.02	0.02	0.02	-1.56	-0.01	-0.01
	0.43	0.00	0.00	0.00	0.32	0.00	0.00
Czech Republic	5.29	1.49	9.16	14.88	-2.86	5.78	10.09
	0.30	0.00	0.06	0.10	0.23	0.05	0.07
Denmark	26.59	11.00	11.84	14.99	-11.73	0.63	3.00
	1.25	0.00	0.07	0.10	0.94	0.05	0.08
Finland	14.18	2.80	2.34	2.36	-8.57	-0.34	-0.33
	0.95	0.00	0.02	0.02	0.71	0.01	0.02
France	19.77	11.22	11.17	13.00	-6.44	-0.04	1.34
	0.79	0.00	0.05	0.08	0.59	0.04	0.06
Germany	13.77	6.13	7.76	10.57	-5.75	1.23	3.34
	0.71	0.00	0.03	0.05	0.53	0.02	0.04
Hungary	3.61	0.47	0.38	0.42	-2.37	-0.07	-0.04
	0.54	0.00	0.00	0.00	0.41	0.00	0.00
Italy	11.64	4.41	3.77	3.99	-5.44	-0.48	-0.32
	0.49	0.00	0.03	0.03	0.37	0.02	0.02
Netherlands	15.20	3.64	3.26	3.54	-8.71	-0.28	-0.07
	0.86	0.00	0.02	0.03	0.64	0.02	0.02
Poland	4.32	0.89	0.88	1.13	-2.59	-0.01	0.18
	0.29	0.00	0.01	0.01	0.22	0.01	0.01
Portugal	5.84	0.25	0.23	0.24	-4.21	-0.02	-0.01
	0.78	0.00	0.00	0.00	0.59	0.00	0.00
Slovakia	2.80	0.21	1.43	2.39	-1.95	0.92	1.64
	0.38	0.00	0.01	0.02	0.29	0.01	0.01
Slovenia	4.95	0.55	0.36	0.35	-3.31	-0.15	-0.15
	0.46	0.00	0.01	0.01	0.35	0.00	0.00
Spain	11.35	3.04	3.34	4.32	-6.25	0.22	0.96
	0.98	0.00	0.02	0.03	0.74	0.01	0.02
Sweden	22.65	7.99	11.86	15.16	-11.04	2.92	5.40
	1.05	0.00	0.06	0.09	0.79	0.05	0.07
United Kingdom	22.13	8.94	9.60	11.06	-9.93	0.50	1.60
	1.79	0.00	0.02	0.05	1.35	0.02	0.04
United States	34.40	57.01	55.97	54.91	17.01	-0.78	-1.58
	0.07	0.00	0.07	0.21	0.05	0.06	0.16

[†] All figures are in € per capita. SQ, AUT, ESM, and FT indicate Status Quo, Autarky, European Single Market, and worldwide Frictionless Trade regimes, respectively. ΔAUT indicates the change in revenue of going from autarky to the Status quo. ΔESM and ΔFT indicate the change in revenue of going from the Status Quo to the ESM and FT regimes, respectively. For each country the standard errors are in indicated in the second row and computed via bootstrapping as described in the text.

B Appendix

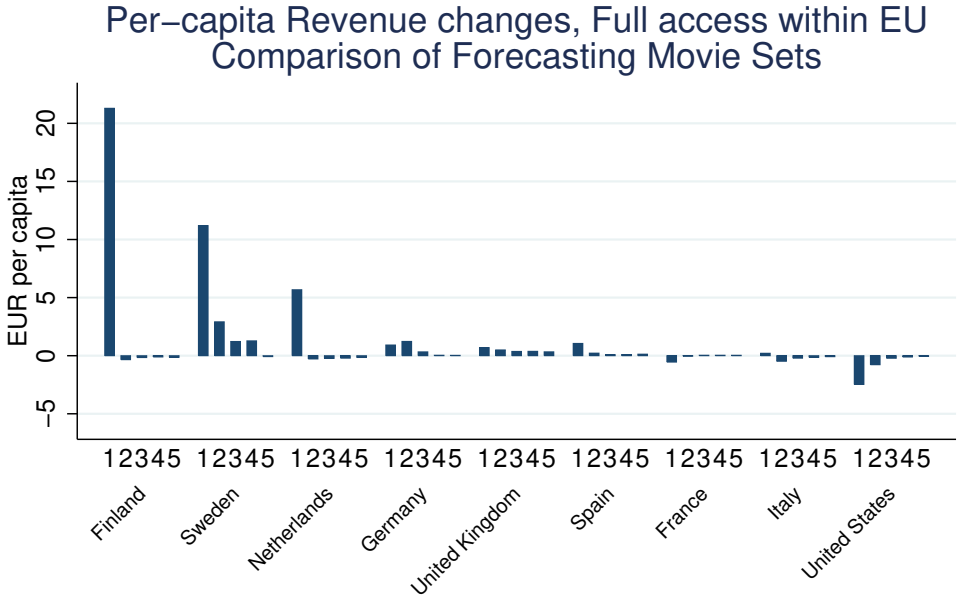
Here we ask how sensitive our counterfactual simulations are to the forecasting model we use to predict the appeal of untraded films. In each of the Figures B.14 to B.17, we compute our counterfactuals using 5 distinct choice sets. We start with a counterfactual choice set that includes all films traded somewhere in the EU (for the DSM counterfactual) and all films traded anywhere (for the worldwide frictionless counterfactual). In these cases, we construct a measure of predicted appeal for every film in our data. Alternatively, we consider a counterfactual choice set where we only include the predicted appeal of films that were exhibited in *at least two* distinct countries. This has the benefit of relying on more information when constructing the predicted appeal measures and corresponds to our main counterfactual exercise as described in the paper (see Section 5). In a third exercise, we impose a greater amount of information to construct our prediction measures and consider a counterfactual choice set where we only include the predicted appeal of films that were exhibited in at least three distinct countries. We similarly perform this exercise for films traded in at least four and five countries. This exercise allows us to see how our forecasting model – in particular, the amount of information used to construct the predictions – affects our final results.

Figures B.14-B.17 clearly show that relying on limited information to predict the appeal of every untraded film (even the ones who only trade in a single destination under the status quo) importantly affects our results (case 1 in the figures). In particular, the size of the effects is much larger (e.g. Figures B.15 and B.17), suggesting that the films that only trade in a single destination are predicted to be very appealing in the destinations where they are originally not traded. This is particularly true for the smallest countries. Bigger countries seem not to be affected as much by this issue.



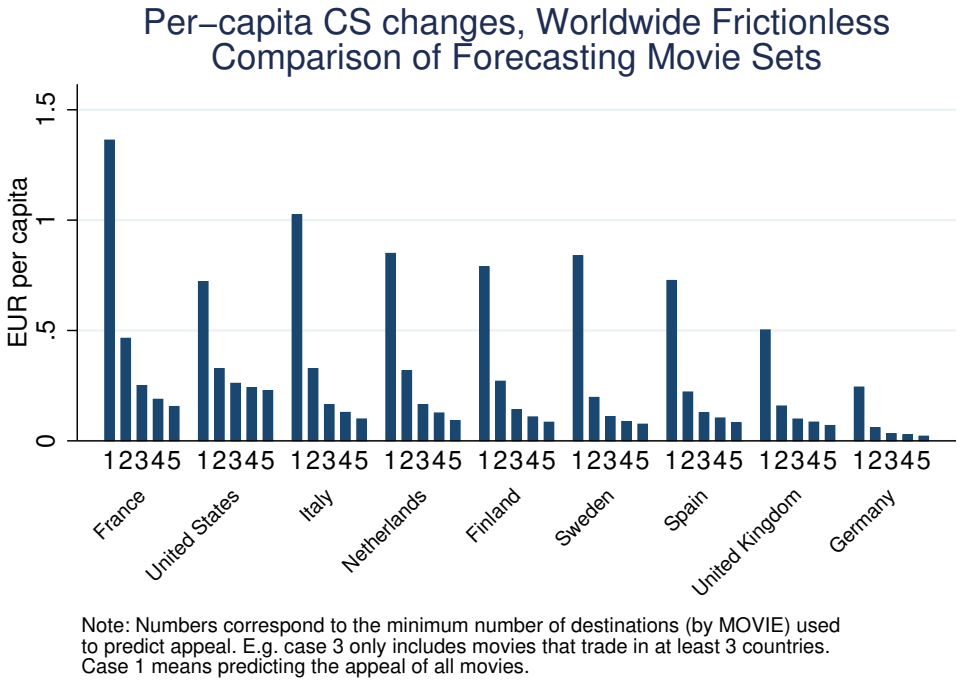
Note: Numbers correspond to the minimum number of destinations (by MOVIE) used to predict appeal. E.g. case 3 only includes movies that trade in at least 3 countries. Case 1 means predicting the appeal of all movies.

Figure B.14: Forecasting film sets and changes in per-capita CS: EU-DSM.



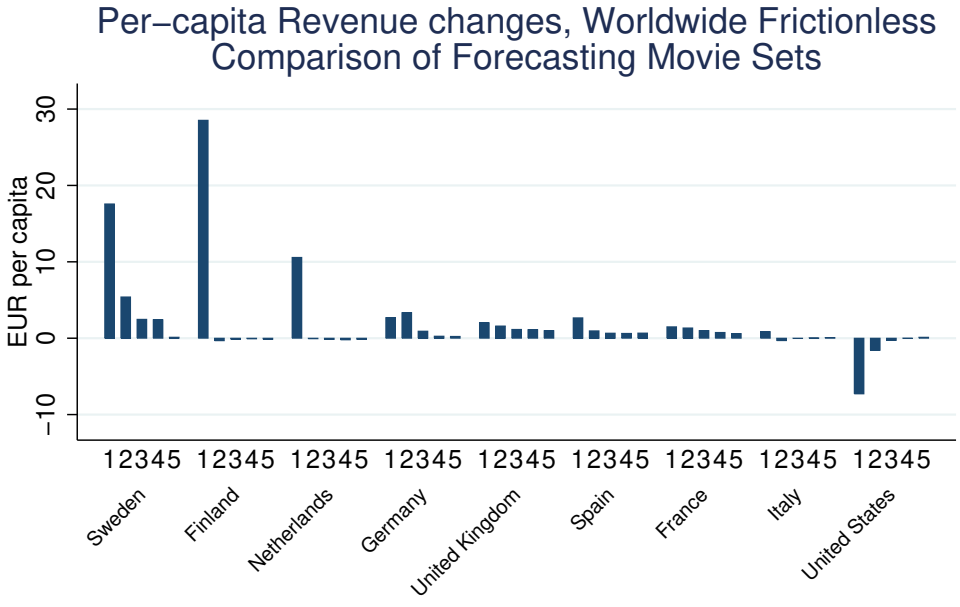
Note: Numbers correspond to the minimum number of destinations (by MOVIE) used to predict appeal. E.g. case 3 only includes movies that trade in at least 3 countries. Case 1 means predicting the appeal of all movies.

Figure B.15: Forecasting film sets and changes in per-capita revenue: EU-DSM.



Note: Numbers correspond to the minimum number of destinations (by MOVIE) used to predict appeal. E.g. case 3 only includes movies that trade in at least 3 countries. Case 1 means predicting the appeal of all movies.

Figure B.16: Forecasting film sets and changes in per-capita CS: worldwide frictionless trade.



Note: Numbers correspond to the minimum number of destinations (by MOVIE) used to predict appeal. E.g. case 3 only includes movies that trade in at least 3 countries. Case 1 means predicting the appeal of all movies.

Figure B.17: Forecasting film sets and changes in per-capita revenue: worldwide frictionless trade.